Art. V.—*New or Little-Known Victorian Fossils in the National Museum.*

Part XI.—On an Impression of a Bird's Feather in the Tertiary Ironstone of Redruth, Victoria.

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(With Plates IV. and V.)

[Read 26th May, 1910.]

Introductory.

Fossil remains of birds, compared with those of other animals, are of rare occurrence. The reason for this is not far to seek. The bodies of birds, on account of their lightness of build, readily float, and are therefore more liable to disintegrate and decay before they can arrive at conditions tending to preservation by being sealed up in mud or silt. Moreover, their bones, with more or less easily attacked pneumatic structure, are placed at considerable odds compared with the more solid bones of mammals, or even of most reptiles. From such floating or decaying bodies the feathers soon tend to become detached; and these, also, have small chance of being preserved, unless caught amidst water-logged masses of leaves. Hence it is that most of the records of fossil feathers are from lacustrine, estuarine or shallow-marine accumulations, where they are generally associated with plant- and insect-remains. The rocks in which feathers have been found are for the most part of fine-grained texture, and comprise iron-stone, originally ferruginous mud or ooze, and gypseous and carbonaceous clays in the lacustrine series; and, more rarely, the impalpable marly deposits of marine origin found in Bavaria (Solenhofen- or Lithographic-Stone).

Previously Recorded Occurrences of Birds' Feathers.

So far, the following appear to be the only instances of feathers having been found in strata older than sub-recent.

Upper Oolite.—Solenhofen, Bavaria (*Archaeopteryx*).

Eocene.—Green River Shales, Wyoming, U.S.A.[1]

Eocene.—Gypseous marls of Aix, Provence (*Strix*, *Alcedo*, *Upupa*, *Sitta* and *Turdus*, associated with plants, insects and fishes).[2]

Upper Eocene.—Mont Bolca, near Verona, Italy (*Ornitholithes faujasi* and *O. tenuipennis*).[3]

Upper Eocene.—Bournemouth. A small feather recorded from the plant-beds by J. Starkie Gardner.[4]

(?) *Eocene.*—Gypseous beds of Senegal.[5]

Lower Oligocene.—Freshwater Limestone of Limagne, Auvergne.[6]

Lower Oligocene.—Königsberg, Germany; in amber.[7]

Upper Oligocene.—Lignite beds of Rott, near Bonn, Germany.[8]

Upper Oligocene.—Two portions of feathers found by the Rev. P. B. Brodie in the Bembridge Limestone, Gurnet Bay, Cowes, I. of Wight.[9]

Miocene.—Freshwater Limestone of Croatia, Austria.[10]

Miocene.—Hard calcareous tufa of Hahnenbergs, Bernstein, Germany.[11]

Miocene.—Lacustrine marls of Florissant, South Park, Colorado, U.S.A.[12]

Upper Miocene.—Oeningen, Bavaria.[13]

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1 Zittel-Eastman. Text-Book of Palaeontology, 1902, p. 256.

2 Bayan. Bull. Soc. Geol. France, sér. 3, vol. i., 1873, p. 386.

3 Faujas. Ann. du Muséum, 1804, vol. iii., pl. i. figs. 1-3; Omboni, Atti Ist. Veneto di Scienze, lettere 1885, ser. vi. vol. iii.

4 Geol. Mag., dec. iii., vol. ii., 1885, p. 384.

5 See Zittel. Traité de Paléontologie (French ed.), vol. iii., 1893, p. 799.

6 Zittel. Loc. supra cit.

7 Zittel. Loc. supra cit.

8 Zittel. Loc. supra cit.

9 Geol. Mag., 1885, loc. supra cit.

10 Zittel. Loc. supra cit.

11 Zittel. Loc. supra cit.

12 Zittel. Loc. supra cit.; see also Bather (Proc. Geol. Assoc., vol. xxi., pt. 3, 1909, p. 159), for general conditions of deposit.

13 Scheuchzer. Physica Sacra, 1731-1735, pl. LIII., fig. 22.

Australian Bird Remains.

Bones of a struthious bird, *Dromornis australis*, Owen,[1] have been recorded from the Pleistocene of Peak Downs and the Paroo River, Queensland;[2] *Dromornis* sp. from the Mount Gambier Caves, South Australia, and Phillip Co., New South Wales;[3] and *Dromaeus patricius*, DeVis, from King's Creek, Darling Downs.[4] Numerous other remains, also from Pleistocene deposits, are recorded by the last-named author from the River Condamine, near Chinchilla, Queensland; chiefly referable to the Anseres and the Rallidae. Another extinct bird, *Genyornis*, allied to the Emus, has been described from the Pleistocene of Lake Callabonna, South Australia, by Messrs. Stirling and Zietz.[5] And lastly, Prof. Spencer has recently described an extinct species of Emu (*Dromaeus minor*), from sub-recent deposits in King Island, Bass Strait.[6] Nothing older than the Pleistocene, however, has been hitherto found in Australian rocks, so that the present occurrence of bird remains has a special interest.

Description.

In the specimens now described, the perfect impressions of the two sides of a feather have been preserved in an ironstone deposit of lacustrine origin below the Wannon Falls, at Redruth, Western Victoria. The two opposite halves of the ironstone block containing the impressions, accompanied by another, bearing numerous leaf-impressions, were forwarded to the National Museum by the Mines Department in 1893.

The feather is moderately long and curved; having a strong quill or rhachis. The impression shows that this rhachis was

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1 Proc. Zool. Soc. Lond., 1872, p. 682. Trans. Zool. Soc. Lond., 1873, vol. viii., pt. 4. pp. 381-384, pl. lxii.; pl. lxiii., figs. 1, 2.

2 R. Etheridge, jnr. Rec. Geol. Surv. N.S. Wales, vol. i., pt. 2, 1889, p. 126.

3 Owen. Proc. Zool. Soc. Lond., 1877, pt. i., p. 95. R. Etheridge, jnr., Cat. Austr. Foss., Cambridge, 1878, p. 179.

4 De Vis. Proc. Linn Soc. N.S. Wales, vol. iii., pt. 8, 1888, p. 1277.

5 Mem. Roy Soc. S. Australia, vol. i., pt. iii., 1906.

6 Vict. Naturalist, vol. xxiii., 1906, p. 159. See also Mem. Nat. Mus. Melbourne, No. 3, 1910, p. 9.

flat, with a well-marked median channel near the base. It is also evident that the medullary portion contained large and irregularly disposed air-spaces. The lamellae lie close together, forming the vane; but occasionally cross one another, as if their cohesion had been destroyed by the damage of the web. The feather is nearly complete to the apex, and there is no appearance of an aftershaft or hyporhachis, such as is seen in the struthious birds. The lamellae curve upwards and outwards from the base of the quill, and are moderately long on one side and short on the other.

Length of feather, 73.5 mm.; greatest width, 20 mm.; width of web on one side of rhachis, 12 mm., on the other, 6.5 mm.; average width of lamellae, .75 mm.; thickness of quill near base, 1.25 mm.

Relationships.

The characters of this feather are not those of a struthious bird[1], there being no after-shaft present; and, moreover, the lamellae are not typically disconnected. In its general firmness of web, its length, slight curvature, and roundly acuminate apex, it suggests such a feather as may be matched amongst the primaries, especially the upper, in, for instance, the Black-billed Spoonbill (*Platalea regia*), or one of the Ibises. Of course, no clear identity can be established from the impression of a single feather; but the probabilities are considerable that, when the ancient lacustrine sediments of Victoria were laid down, some representatives of the long-legged wading birds of the order Herodii were living under conditions similar to those which they enjoy at the present day.

Associated Remains and Probable Age of the Beds.

On the same pieces of ironstone with the feather-impressions are some slender, cylindrical and pointed fragments, with fluted surfaces, which are probably portions of reed-like stems of

1 See also Hutton "On Some Moa Feathers." Trans. and Proc. N. Zealand Inst., vol. iv. (1871), 1872, p. 172, pl. ix.

plants allied to the rushes. Several fragments of long, ovate, pointed leaves on the same slab can, without doubt, be referred to the genus *Eucalyptus*. Their venation differs from those of the fossil species described by McCoy and Ettingshausen, in having remarkably long and sub-parallel secondary veins; and in point of fact, very closely agree with the leaves of *E. amygdalina*, Labill. The areolar interspaces formed between the secondary and tertiary veins are occupied by moderately large pustular oil-cells. On two separate fragments of the same ironstone bed there are numerous leaves of a *Banksia*, allied to *B. marginata*, Cavanilles, but having a narrow, parallel-sided ligulate form of leaf. The presence of a new species of *Banksia*, allied to a species now found living in the same locality, is interesting, as pointing to the same generic element in the flora of that tolerably remote period. And this, together with the occurrence of a *Eucalyptus* allied to the living *E. amygdalina*, proves that the characteristic flora of the "open forest type,"[1] had already become established. The evidence of marine fossils in ironstone bands above the older "gold-drifts" is in favour of a Janjukian or Miocene age; but whether this ironstone with terrestrial remains is a synchronous deposit can only be proved by further detailed stratigraphic work in the district whence it came. In appearance and general characters it closely resembles a typical ironstone of the Bacchus Marsh series with plant-remains; and also the Stawell ironstone deposit containing moderately shallow-water marine fossils.

In concluding these notes I must express my thanks to Mr. J. W. Audas, of the National Herbarium, who kindly assisted me in the comparison of the plant-remains here mentioned.

EXPLANATION OF PLATES IV. AND V.

Plate IV.

Fig. 1. Impression of a bird's feather in ironstone; associated with leaves and stems. Redruth, Western Victoria. Nat. size.

1 See H. Deane, Rec. Geol. Surv. Vict., vol. i., pt. 1, 1902, p. 18.

2.—Opposite face of above ironstone specimen; showing impressions of feather, grooved plant-stems, and leaf of *Eucalyptus*, of the type of *E. amygdalina*, Labill. × $\frac{4}{5}$.

PLATE V.

Fig. 3.—Feather impression more highly magnified; showing the connected structure of the vane. × 23.

4.—Piece of ironstone from the same bed as that with the feather impression; filled with leaf-impressions of a *Banksia* allied to *B. marginata*, Cavan., but probably a new species. Nat. size.